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EP 23830A
EP 23829A
GB 1552116
GB 1245364
GB 1111423
GB 1095781
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GB 945439
GB 450206
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(54) Solid foam fuels

(57) Solid foams, suitable as fuels and used for kindling fires, or for the ignition of waste products, eg. oil slicks contain liquid to solid hydrocarbons, eg. kerosene, paraffin wax, crude petroleum wax mixtures, petroleum, Diesel oil, fuel oil etc. as dispersed phase, the composition containing:
a) 21 to 54 per cent by mass water,
b) 0 to 35 per cent by mass solids,
c) 40 to 75 per cent by mass hydrocarbons, and
d) 3 to 20 per cent by mass framework-forming substances.

The framework-forming substances may be a hardenable prepolymer or hardenable resin. The composition may include dispersion aids and water as continuous phase and possibly integrated solids.

The hardenable resin or prepolymer and modification agents are mixed with the water and dispersion aids, in an emulsifier, to a fine dispersion then liquid hydrocarbons, solids, and optionally inert gas (eg. air) is emulsified in a second emulsifier with addition of a hardener.

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SPECIFICATION

Combustible composition and process for its production

The invention relates to combustible compositions in the form of solid foams which are suitable as fuels, consisting of hydrocarbons, hardenable prepolymer or hardenable resin, dispersion aids, water and acids or alkalis as hardener components, and are used predominantly for the kindling of fires as coal fire lighters, barbecue lighters and the like or for the ignition of waste products, such as oil slicks *inter alia*, and to processes for their production.

It is known that solid foams, consisting of liquid to solid hydrocarbons as dispersed phase and any desired hardenable prepolymer or hardenable resin, usually a modified urea formaldehyde condensation product in aqueous solution as continuous phase, cationic or anionic or non-polar dispersion aids and organic or inorganic acids as hardener components, serve as solid propellants, fuels or as transport form for propellants and as ignition aids, especially for wood, charcoal, barbecue fuel, briquettes and others.

In GDR Patent WP 68,891, for the continuous production of solid foams from liquid to solid hydrocarbons there are used a hydrocarbon on the one hand and a urea formaldehyde resin sol, produced by polycondensation from urea, formaldehyde and an ammonium sulphide, possibly further ammonium compounds and hardener components, on the other hand. The resin sol, the hydrocarbon, the alkyl sulphonate solution as emulsifier and the phosphoric acid as hardener are fed to an emulsifying machine and emulsified therein, and the formed emulsion is extruded from an extrusion mould.

For technological reasons of emulsion formation, water is absolutely necessary for the production of solid foams as fuels. Thus according to GFR Pub. Sp. 2,645,872 5–10 % by mass, according to GFR Pub. Sp. 1,917,052 5–18 % by mass and according to GDR P.S. 48,817 20.9 % by mass of water content are stated. In GFR Pub. Sp. 2,631,038, up to 20 % by mass water content is described.

On the other hand in the patents GDR PS 57,839, GDR PS 41,994, GDR PS 35,739, GFR Pub. Sp. 2,937,273, GFR Pub. Sp. 1,571,713, Swiss P.S. 566,386 and Swiss P.S. 552,051 water-free hydrocarbon-containing fuels are described, since for their production the use of water is not technologically compelled when solid hydrocarbons are used. Accordingly the manufacturers of coal fire lighters, despite over twenty years of production time, were prejudiced with regard to the addition of water beyond the technologically necessary quantity in the production of coal fire lighters.

The rational use of solid foams as solid fuels, especially as coal fire lighters, requires good strength properties of the consolidated product, good ignition, heating and after-burning properties. Type testing and the evaporation coefficient have proved their value as testing methods for coal fire lighters. In type testing, the capacity for ignition of a standard coal is determined with a quantity of 25 g. of coal fire lighter; in the case of the evaporation coefficient, again with 25 g. of coal fire lighter, the quantity of water which is evaporated by the heat of combustion is determined.

It is known that for the production of solid foams as fuels, aliphatic, aromatic, liquid and solid hydrocarbons are suitable either pure or in mixture (GFR Pub. Sp. 2,210,940, GDR PS 35,739, GFR Pub. Sp. 1,917,052). It is known that for the production of solid foams which are to be used as coal fire lighters, the requirement exists for sufficiently rapid evaporation for the utilised hydrocarbons. Thus for their production, high-boiling, cheap hydrocarbons are only conditionally suitable, if at all, since when they are used the solid foams drip in burning. Such unsuitable but cost-favourable hydrocarbons are paraffins, paraffin wax, crude petroleum wax mixtures, heavy fuel oil and the like.

According to WP 68,891 in fact it is currently possible to process a wide spectrum of liquid to solid hydrocarbons into solid foams with different quality features, but all solid foams produced hitherto have, as coal fire lighters, the disadvantage that the utilised hydrocarbons and/or their mixtures with low boiling points or a high proportion of low-boiling components burn in relatively short times incompletely, with heavy generation of soot. For this reason the necessary coefficient of evaporation, in the known solid foams which are used as coal fire lighters, without addition of solid fillers, is achieved only with a high proportion of hydrocarbons in the total composition.

It is further known that an increase of the burning duration of coal fire lighters can be achieved by the use of solid inert adsorbents, for example silicon dioxide, alumina, carbons such as activated charcoal, anthracite dust, wood flour, etc., and gaseous inert substances, for example air. However this effect is achieved at the cost of the heating output, that is liberation of the same combustion heat as without inert adsorbents, but over a longer period. Here the generated quantity of soot with and without these inert substances differs only inappreciably.

It is further known from GFR Pub. Sp. 2,328,631 that acid-hardenable resins such as carbamide resins, for example melamine formaldehyde resins, dicyanodiamide resins, urea formaldehyde resins, furfuryl alcohol urea

formaldehyde resins, can be used as hardenable material. These resins are distinguished by heat-stability of their hardened structures. It is also possible to use hydroxylated or amino-modified urea formaldehyde resins in part in mixture with polyamides. The properties of the resins are dependent upon the selected molar ratio of the initial compounds in their production. Moreover furfuyl alcohol resins or other furfuryl aldehyde resins can be used.

For acid-catalysed hardening it is possible to use any desired material which is sufficiently acid, especially inorganic and organic acids, for example phosphorus oxy-acids, sulphuric acid, nitric acid, hydrochloric acid or p-toluene-sulphonic acid, also base-catalytically hardenable resins such as phenol formaldehyde resins, resorcin formaldehyde resins and such resins in which a part or the whole of the resorcin is replaced by another component such as cresol are described. The hardening takes place with alkali hydroxides, preferably sodium hydroxide. Anionic or cationic emulsifiers, for example alkyl or alkyl aryl sulphonates or quaternary ammonium compounds etc. are used as dispersion aids, and for example carboxy methyl celluloses are used as stabilisers.

Further devices for the production of dispersions and processes are known which permit of producing solid foams exclusively from liquid components (GDR WP 76,352, GDR WP 82,905) or equally from liquid and solid components (GFR Pub. Sp. 2,328,631).

It is the aim of the invention to develop new combustible compositions in the form of solid foams, which are suitable as fuels and are used predominantly for the kindling of fires as coal fire lighters, barbecue lighters and the like, or for the ignition of waste products or harmful substances such as oil pools etc., and processes for their production, which with higher utility value properties and lower production costs display better burning properties.

It is the problem of the invention, in comparison with the known technical solutions, substantially to reduce the proportion of highly refined combustible hydrocarbons in new combustible compositions, hereinafter called solid foams, and to replace this proportion of cheap liquid substances.

In accordance with the invention the new solid foams consist of liquid to solid hydrocarbons, for example kerosene, paraffin wax, crude petroleum wax mixtures, petroleum, Diesel oil, fuel oil, etc. and/or mixtures thereof as dispersed phase, the composition containing:

a) 21 to 54 per cent by mass of water,
b) 0 to 35 per cent by mass of solids,
c) 40 to 75 per cent by mass of hydrocarbons, and
d) 3 to 20 per cent by mass of framework-forming substances.

These proportions being based on the total mass of the foam.

As framework-forming substances there are preferably used a hardenable prepolymer or hardenable resin e.g. poly-condensation products from urea or urea derivatives and formaldehyde, also modification means, hardener components, as organic or inorganic acids, and emulsifiers and stabilisers. The composition may include dispersion aids and water as continuous phase and possibly integrated solids.

It is known that hydrocarbon-containing fuels serving for example as coal fire lighters are subject to incomplete combustion and accordingly form soot, whereby a lower combustion enthalpy occurs than in the case of complete combustion into carbon dioxide.

Surprisingly it has been found that by the addition of water beyond the technologically necessary proportion of 5 to 20 per cent by mass, in the production of new combustible compositions, a combustion-promoting effect of the water occurs with a reduction of the soot generation of over 10 % in the burning of the composition according to the invention. At the same time a reduction of the hydrocarbon proportion is possible while retaining or improving the utility value properties. The increase of the water proportion to 21 to 54% by mass, preferably 21–45 % mass, and the reduction of the hydrocarbon proportion to 75–40 % mass result in a solid foam which burns with greatly reduced soot generation and heat generation equal to or greater than a solid foam with a hydrocarbon proportion of over 75 %.

The facilitating effect of the water proportion in the achievement of a complete combustion negates the simple and obvious conclusion from experience that only high hydrocarbon proportions in the solid foam guarantee high combustion heats.

Since high liquid proportions in known manner favour the tendency of solid foams to sweating, it is necessary in the case of high water proportions to increase the framework-forming proportion. The increase of the proportion of the framework-forming substances favourably influences the dripping behaviour of the solid foam in the burning operation so that the proportion of higher-boiling hydrocarbons in the total hydrocarbon content can be increased. The reduction of the water content during storage as a result of vaporisation effects is not greater, under equal packaging and storage conditions, than in the case of solid foams with hydrocarbon proportions above 75 %.

It has further been found according to the invention that high-boiling hydrocarbons can be used with addition of a solid for the production of combustible compositions. The solid foams produced according to the invention contain 21 to 54 % by mass of water, up

to 35 % by mass of solids, 40 to 75 % by mass of hydrocarbons and 3 to 20% by mass of the framework-forming substances.

For these solid foams there are used liquid to solid hydrocarbons, for example paraffin wax, crude petroleum wax mixtures, kerosene, petroleum, Diesel oil, heavy fuel oil etc. and/or mixtures thereof, an integrated solid which can be carbon in the form of pit coal dust, lignite dust, peat or wood flour and products thereof which occur by thermal treatment and/or inert inorganic materials, for example aluminium oxide, silicon dioxide, etc., and a solid framework consisting of a hardenable prepolymer or hardenable resin, usually a modified urea formaldehyde condensation product in aqueous solution and modification means, emulsifiers, stabilisers and hardener compoments, with admixture of water as liquid inert constituent, for the achievement of a maximum heat generation in burning.

There is a necessary relationship between the utilised hydrocarbons and the duration of ignition and the solid conversion for the stabilisation of the solid foam in the sense of prevention of dripping. The reduction of the low-boiling hydrocarbons in the hydrocarbon mixture lengthens the duration of ignition. The increase of the high-boiling hydrocarbon proportion at the same time necessitates an increase of the solid proportion, to prevent dripping.

For the production of solid foams with and without addition of solids a finely dispersed distribution of the hydrocarbon in the continuous phase and an extensive homogeneity of the continuous phase are necessary. The processes used hitherto of mixing of the urea formaldehyde resin syrup with water and dispersion means in the agitator vessel do not permit to an adequate extent of achieving a finely dispersed resin dispersion. The dispersion process of the flocculating glue through the emulsifier is simultaneously superimposed with the emulsifying action of the hydrocarbon. The generation of a finely dispersed product thus can be achieved only with long times of sojourn in the emulsifying machine.

It is therefore the problem of the invention also to develop a new process for the production of new combustible compositions in the form of solid foams which at the same time guarantees a high productivity by the emulsifier and delivers a sufficiently finely dispersed product.

In accordance with the invention this problem in the production of finely dispersed products which can be extruded in continuous form and after a short setting time solidify into solid foams is solved in that the mixture of the resin syrup with water and liquid modification means takes place not in the agitator vessel but in a second emulsifying machine. If this second emulsifying machine is placed directly before the main emulsifying machine, no intermediate quantity regulation of the modified water-resin syrup dispersion is necessary. Since the second emulsifying machine is substantially smaller and less energy-intensive that the required agitator vessels, reductions result in the apparatus costs and working costs.

This new process is usable for the production of combustible compositions both with and without addition of solids.

Furthermore it is possible from these new solid foams with or without addition of solids, with direct addition of a gas component, for example air, into the main emulsifier, in known manner according to GDR P.S. 122,688, to obtain a solid foam with lower density but the same combustion qualities as conventional products. The produced products are lighter than water and are therefore suitable for the ignition of hydrocarbons, such as oil pools etc., floating on water.

The new solid foams produced in accordance with the invention are distinguished, despite the reduced proportions of combustible components, under utilisation conditions by a controlled combustion with lower generation of soot. At the same time the duration of burning is lengthened. The mechanical stability of the product is dependent upon the proportions of framework formers in the total composition and is not influenced by the proportion of water.

The invention will be explained below by reference to 15 examples of the new combustible composition and an example of the new process:–

Example 1

138 kg. of urea formaldehyde resin syrup with a solid content of 50 % mass, 185.5 kg. of water and 7.5 kg. of an aqueous alkyl sulphonate solution containing 35 % by mass are mixed with one another in an agitating vessel. This mixture on the one part and a mixture of 660 kg. of Diesel fuel and 9 kg. of a dilute 30 % mass phosphoric acid on the other are fed to an emulsifying machine, there continuously emulsified and the formed emulsion is extruded in an extrusion mould.

The continuous length thus produced solidifies quickly after a few seconds of setting time and is made up in known manner.

The solid foam thus produced starts burning immediately on lighting. 25 g. of the product burn without dripping for 20 to 27 minutes and achieve an evaporation coefficient of 50 g. of water.

Example 2

The production of the solid foam takes place analogously with Example 1. In place of Diesel oil, 660 kg. of kerosene are used.

On lighting the product immediately starts burning. 25 g. of the product burn without dripping for 18 to 25 minutes and achieve an

evaporation coefficient of 35 g. of water.

Example 3

200 kg. of urea formaldehyde resin syrup with a solid content of 50 % by mass, 9 kg of an aqueous alkyl sulphonate solution containing 35 % by mass and a solution of 3 kg. of carboxy methyl cellulose in 376 kg. of water are mixed with one another in an agitating vessel. This mixture and a mixture of 400 kg. of kerosene and 12 kg. of a dilute 30 % mass phosphoric acid are fed continuously to an emulsifying machine and emulsified and the emulsion formed is extruded in an extrusion mould. The continuous length thus produced solidifies rapidly after a few seconds of setting time and is made up in known manner. As a result of the high water content the product tends to sweat out water during the hardening process, and should be surface-dried before making up.

Example 4

150 kg. of urea formaldehyde resin syrup with a solid content of 50 % by mass, 8.2 kg. of an aqueous alkyl sulphonate solution containing 35 % by mass, and 332.3 kg. of water are mixed with one another. The mixture can be stored before use. However it must in that case be stirred slightly, since otherwise the urea formaldehyde resin tends to flocculate and settle out.

The mixture thus produced, 500 kg. of Diesel fuel and 9.5 kg. of a 30 % mass phosphorous acid are separately fed continuously to the emulsifier, emulsified, and the formed emulsion is extruded into a continuous form. The continuous length solidifies after a few seconds setting time, and after 20 to 30 minutes hardening time can be made up in known manner.

Example 5

Methyl urea formaldehyde resin syrup is produced in known manner analogously to urea formaldehyde resin syrup. Methyl urea is merely used in place of urea for the production.

345 g. of a methyl urea formaldehyde resin syrup with a solid content of 20 % by mass are mixed with 7.5 g. of an alkyl sulphonate solution containing 35 % by mass, in a two litre agitator vessel.

This mixture is stirred by means of a high-speed agitator and 600 g. of petroleum are emulsified with vigorous introduction. A mixture of 9 g. of 30 % mass phosphorous acid and 38.5 g. of water is united in one pouring action with this emulsion. The emulsion is restirred for 5 seconds and for portioning it is poured immediately into moulds in which it hardens out after a few minutes.

Example 6

Thio-urea formaldehyde resin syrup is produced in known manner analogously with urea formaldehyde resin syrup, using thio-urea in place of urea.

345 g. of a thio-urea formaldehyde resin syrup with a solid content of 20 % by mass are mixed with 7.5 g. of an alkyl aryl sulphonate solution, containing 35 % by mass, in a 2 litre agitating vessel. By means of a high-speed agitator a hydrocarbon mixture of 500 g. of kerosene and 100 g. of mixed paraffin waxes is emulsified into this mixture. The hydrocarbon mixture is transferred into the liquid state of aggregation by stirring and heating to 40° C. A mixture of 9 g. of 30% mass phosphorous acid and 38.5 g. of water is united with this emulsion in one pouring action. The emulsion is restirred for 5 seconds and for portioning is poured immediately into moulds in which it hardens out in a few minutes.

Example 7

By means of a quantity-regulating pump the following mass currents are fed, separately and continuously, directly to an emulsifying machine:

220 kg./h. of a urea formaldehyde resin syrup containing 50 % solid by mass,
10 kg./h. of an aqueous alkyl aryl sulphonate solution containing 35 % by mass,
25 kg./h. of a 15 % mass hydrochloric acid,
295 kg./h. water and
450 kg. of a hydrocarbon mixture consisting of 300 kg. of kerosene and 150 kg. of Diesel fuel.

The formed emulsion is extruded into a continuous form. The ensuing continuous length solidifies after a few seconds setting time and is made up in known manner.

Example 8

280 kg. of urea formaldehyde resin syrup with a solid content of 50 % by mass, 10 kg. of an aqueous alkyl sulphonate solution containing 35% by mass, and 265 kg. of water are mixed in an agitating vessel. This mixture on the one part and a mixture of 420 kg. of kerosene and 25 kg. of a 30 % mass phosphoric acid on the other are fed continuously to an emulsifying machine and emulsified and the formed emulsion is extruded to a continuous form. After a few seconds setting time the continuous length thus produced solidifies and can be made up in known manner.

Example 9

145 kg. of urea formaldehyde resin syrup with a solid content of 20 % by mass, 8 kg. of an aqueous alkyl sulphonate solution containing 35 % by mass, and 288 kg. of water are mixed in an agitating vessel. This mixture, 550 kg. of Diesel fuel, 9 kg. of a 30 % mass phosphoric acid and at the same time 100 l. of air are fed continuously to an emulsifying machine and emulsified and the formed emul-

sion is extruded into a continuous form. After a few seconds setting time the continuous form thus produced solidifies and can be made up. The product reaches its final hardness after 30 to 50 minutes.

Example 10

By means of a quantity-regulating pump the following mass or volume currents are fed, separately and continuously, directly to the emulsifying machine:
120 kg./h. of a urea formaldehyde resin syrup containing 50 % by mass,
7.5 kg,/h. of an aqueous alkyl sulphonate solution containing 35 % by mass,
710 kg./h. of Diesel fuel,
155 kg./h. water
7.5 kg./h. of a 30 % mass phosphoric acid and 200 litres of air.

The formed emulsion is extruded into a continuous form. The occurring continuous length solidifies after a few seconds of setting time and is made up in known manner.

Example 11

As Example 10, only without addition of air.

Example 12

124 kg. of urea formaldehyde resin syrup with 50 % mass water content, 149 kg. of water and 7.5 kg of a 35 % mass alkyl sulphonate solution are mixed in an agitating vessel. This mixture for the one part and a suspension of 200 kg. of Diesel fuel, 200 kg. of fuel oil and 9.5 kg. of 30 % mass aqueous phosphoric acid, 100 kg. of water and 310 kg. of bleaching earth residues in powder form, consisting of 65 % by mass of lignite dust, 5 % mass Al_2O_3, 20 % mass of solid hydrocarbons and 10 % mass moisture content, are fed to an emulsifying machine and continuously emulsified therein and the formed dispersion is extruded to a continuous form. The continuous length thus produced solidifies after a short setting time and is made up in known manner.

Example 13

Production takes place analogously with Example 1. A mixture of 164 kg. of urea formaldehyde resin syrup with 50 % mass water content, 13 kg. of a 35 % mass aqueous alkyl aryl sulphonate solution and 214 kg of water is emulsified with a suspension of a hydrocarbon mixture, consisting of 300 kg. of Diesel fuel and 200 kg. crude petroleum wax mixture and 100 kg. of pit coal dust. The suspension is produced by dissolving of the crude petroleum wax mixture in Diesel fuel at 30° C. and subsequent suspension of the coal dust with agitation in this solution. 9 kg. of 30 % mass phosphorous acid are used as hardener component.

Example 14

The production takes place analogously with Example 1.

A mixture of 164 kg. of urea formaldehyde resin syrup with 50 % by mass water content, 13 kg. of a 35 % mass aqueous alkyl sulphonate solution and 233 kg. water is emulsified with a suspension consisting of a hydrocarbon mixture with 300 kg. of Diesel fuel, 180 kg. of heavy fuel oil and 100 kg. of bleaching earth residue. 10 kg. of 30 % mass phosphoric acid are used as hardener component.

Example 15

188 kg. of urea formaldehyde resin syrup with 50 % mass water content, 301 kg. of water, 16 kg. of a 35 % mass aqueous alkyl sulphonate solution, 300 kg. of Diesel fuel, 80 kg. of kerosene and 15 kg. of a 30 % mass phosphoric acid are each measured out by a quantity-regulating pump and fed continuously to an emulsifying machine. 100 kg. of lignite high-temperature coke dust are metered as solid into the settling space of the emulsifying machine by a worm conveyor. The formed dispersion is extruded into a continuous form, solidifies after a few seconds setting time and is made up in known manner.

Example 16

The following main equipment is necessary for the realisation of the process according to the invention:–
2 quantity-regulating machines, 1 pre-emulsifier and 1 main emulsifier, 1 dispersion vessel and various storage containers for hydrocarbons, water, urea formaldehyde resin syrup, emulsifier, stabiliser, hardener and solids.

In the dispersion vessel, for example a storage container provided with an agitating mechanism and expediently equipped with a temperature-control apparatus, hydrocarbons can be mixed with one another and provided with additions of solids. The hydrocarbon mixtures or suspensions are fed by means of a suitable quantity-regulating machine to the main emulsifying machine. The direct solid metering takes place through a second solid metering machine into the settling space of the main emulsifier, since no high demands are made of the distribution of the solid. The urea formaldehyde resin syrup and dispersion aid components, forming the framework, are metered like the water individually into the pre-emulsifier and there a finely dispersed mixture is produced. It is also possible to mix the components before the pre-emulsifier and feed them in mixture thereto. The mixture leaving the pre-emulsifier is fed to the main emulsifier, like the other components, including the hardener and possible a gas component, and then extruded into a continuous form.

CLAIMS

1. Combustible composition containing liquid to solid hydrocarbons and/or mixtures thereof as dispersed phase, comprising:
a) 21 to 54 per cent by mass of water,
b) 40 to 75 per cent by mass of the hydrocarbons, and
c) 3 to 20 per cent by mass of framework-forming substances serving as a hardenable prepolymer or hardenable resin, these proportions being based on the total mass of the foam.

2. Composition as claimed in claim 1, wherein the hardenable resin s framework-forming substance is a poly-condensation product of urea or urea derivatives and formaldehyde and modification agents.

3. Composition as claimed in claim 1 or 2, wherein up to 35 per cent of an additional solid are contained.

4. Composition as claimed in claim 3, wherein the additional solid is constituted by a carbon carrier such as coal dust, lignite dust, peat or wood flour or a product obtained from these substances by thermal treatment.

5. Composition as claimed in claim 3, wherein the additional solid is an inert inorganic material.

6. Composition as claimed in claim 3 or 4, wherein the additional solid is constituted by a mixture of two or more of the stated solids.

7. Process for the continuous production of a combustible composition in the form of a solid foam, consisting of liquid to solid hydrocarbons and/or mixtures thereof, a hardenable prepolymer of hardenable resin, modification agents, water, hardener components, emulsifiers, stabilisers, with or without solids and gas components individually or simultaneously, wherein the hardenable resin or prepolymer and modification agents are brought in common with the water and dispersion aids in an emulsifying machine into a finely dispersed condition and this mixture with liquid hydrocarbons and a solid addition, either dry directly or as suspension, in combination with a liquid component or a mixture of several liquid components, is emulsified in a second emulsifying machine with addition of a hardener.

8. Process as claimed in claim 7, wherein in addition an inert gas is introduced into the emulsion in quantities of 1 to 25% by volume, preferably 10 to 15% by volume, in relation to the total volume.

9. Process as claimed in claim 7 or 8, wherein the hardenable resin is produced especially by polycondensation of urea or urea derivatives and formaldehyde with addition of appropriate modification agents, the liquid to solid hydrocarbon is constituted especially by kerosene, petroleum, Diesel oil, fuel oil or paraffin wax or mixtures of these substances, and the solid added before or after the emulsification is pit coal dust, lignite dust, peat flour, wood flour or an inert inorganic material or a mixture of two or more of these substances.

10. Use of compositions as claimed in any one of claims 1 to 8 for the ignition of combustible materials, especially briquettes, charcoal, barbecue fuel and in the form of a solid foam with density lower than that of water for the ignition of oil slicks on water.

11. Combustible composition containing liquid to solid hydrocarbons and/or mixtures thereof as dispersed phase substantially as described herein.

12. Process for the continuous production of a combustible composition in the form of a solid foam substantially as described in any one of the examples.

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